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by

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The Determination of the Specific Gravity of Mineral Fragments by Heavy Liquids.

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It not infrequently happens that a determination of the specific gravity affords one of the readiest means of identifying a doubtful species, or of ascertaining its composition if it be an isomorphous mixture, such as a plagioclase feldspar. In many such cases, as for instance where minute feldspar crystals are distributed through a rock, it may be a long and tedious process to isolate, in a pure state, a sufficient quantity of material for the pycnometer, or any other method involving weighing, while the employment of such methods becomes impossible when only one or two minute crystals or fragments of the mineral are available. At such times, the employment of the heavy liquid method becomes advantageous or imperative. The usual procedure is to immerse one or more fragments of the mineral in the liquid or solution selected, add a suitable diluent to the latter until the mineral remains exactly in suspension, and then find the specific gravity of the liquid by introducing substances of progressively increasing or decreasing density from a standard set. As a rule, however, there are frequent wide gaps between successive indicators in such sets, and unless these can be bridged by additional test fragments, it becomes necessary if the result is to be at all accurate, to make an actual determination of the specific gravity of the heavy liquid by the Westphal balance or some other method.

To overcome this difficulty, Sollas[1] suggested the diffusion column, which he obtained by placing some methylene iodide in a tube, carefully adding benzene, and then allowing the mixture to stand for some time. In this way there results a column of liquid whose density increases in a uniform manner from the surface downward to the bottom. The desired specific gravity of any fragment is then found accurately from its position of suspension relative to the positions of two substances of known specific gravity, one lighter and the other heavier than the unknown.

The writer's experience with the diffusion column has not been altogether successful, and, in place of it, he has found the simple and rapid burette method described below to give good results.

[1] "Nature," February 26th, 1891.

Several indicators from a standard set are placed in a large test-tube, some being lighter and others heavier than the substance whose specific gravity is required, which also is introduced—preferably three or four pieces, if obtainable. The heavy liquid to be used is then poured in, and the tube closed with a cork through which two holes have been bored. A stirrer is introduced through one hole and the tip of a burette is inserted through the other, both fitting loosely. The burette being filled with the diluent, the latter is now run in, with constant stirring of the contents of the test-tube, until the first indicator remains exactly suspended, or barely sinks, when the burette reading is taken. Further readings are made as the liquid attains equilibrium with each of the remaining indicators, and also with the fragments of the unknown mineral. The burette readings are then plotted against the known specific gravities of the indicators, and the value for the mineral is found from the point at which its burette reading intersects the resulting curve.

It is not necessary to use more than three indicators, whose limits of specific gravity embrace that of the mineral fragment to be identified, since the data obtained from them will furnish three points which determine the curve; but in practice it is better to obtain readings for five or six indicators, some lighter and others heavier than the substance, whereby the curve can be more accurately drawn.

The method can be made as accurate as desired by employing a comparatively large volume of the original heavy liquid, since correspondingly large amounts of diluent will then have to be added in order to produce a given change in the density of the liquid; the curve will approach the form of a straight line, and points upon it which indicate only a small difference in specific gravity will be widely separated.

The advisability of starting with as much as, say, 15 or 20 c.c. of the original liquid renders this method more suitable for use with methylene iodide than with any of the aqueous solutions, such as Thoulet's, which would have to be diluted with water, and subsequently concentrated again to be of any further use. In the case of methylene iodide, the question of volume is not a very serious matter, since the liquid solidifies at about 5° C, and can by this means be readily freed from the added benzene.

The test-tube being closed, there is comparatively little loss of benzene by evaporation during the course of a determination; and since any evaporation which does take place proceeds at an essentially constant (or only slightly increasing) rate, the possible error due to this factor is about equally distributed throughout the plotted curve, and does not materially affect the accuracy of the method.

The specific gravities of several different substances may be determined, if desired, during the course of a single experiment. The method is also especially convenient in determining the character of the plagioclase feldspar in rocks. For this purpose, optical methods, such as a measurement of extinction angles, or of the mean refractive index, are perhaps more commonly employed, but the plagioclase in a rock being usually not all of the same composition, there is always the danger that the fragments examined do not represent the principal feldspar present. By carrying out a specific gravity determination as described above, however, it is possible to arrive at a knowledge of the composition, not only of the principal feldspar, but also of the most acid (lightest) and most basic (heaviest) varieties present.

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